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Normal electrocardiographic parameters of Auraki donkeys in Sokoto, Nigeria: baseline for adaptation

^{*1}Saidu, B, ¹Jafaru, A.I, ¹Ibrahim, H.M., ¹Abdulrasheed, A, ¹Abdulazeez, N, ¹Dahiru, A, ²Bamaiyi, A. J, ³Abdullahi, A. M and ⁴Pilau, N.N.

¹Department of Physiology and biochemistry, Faculty of Veterinary Medicine, Usmanu Danfodiyo University Sokoto, Nigeria.

²Department of Physiology, Faculty of Basic Medical Sciences, College of Health Sciences, Usmanu Danfodiyo University, Sokoto, Nigeria.

³Veterinary Teaching Hospital, University of Maiduguri, Borno, Nigeria.

⁴Department of Medicine, Faculty of Veterinary Medicine, Usmanu Danfodiyo University, Sokoto, Nigeria

Corresponding Author: Nicholas pilau @gmail.com **Phone Number:** +2347032409535

Target Audience: Veterinary and Para-veterinary clinicians, Diagnosticians, Medical illustrators, Animal health technologists, Animal scientists, Students and Equine enthusiasts

Abstract

Donkey is becoming an endangered species regionally in northwestern Nigeria and nationally. Indigenous species have suffered a sharp decline in population from hunting, diseases and slaughter as food animals by different tribes in Nigeria. Very little information on their cardiac excitability is available, owing to negligence and lack of comprehensive and coherent national program on donkeys' conservation and preservation, hence the need to carry out the study. The study was carried out using 22 apparently healthy Jacks (male donkeys) with a mean age of 8 ± 0.7 years and an average weight of $135\text{kg} \pm 0.5$. The donkeys were manually restrained on standing position on an insulated ground surface using a rubber mat; Electrocardiogram was conducted using single lead channel ECG recorder (EDAN VE-100). The durations of P, R, T, QRS, P-R interval and Q-T interval were recorded as well as the amplitudes of P, R and T. The highest amplitude of P-wave was obtained in lead II while the highest R-wave amplitude was obtained in lead aVR. P and T wave's durations were highest in lead aVR while higher R-wave and QRS complex durations were obtained in leads aVL and aVF, respectively. The P-R and Q-T intervals (duration) were highest in lead I. Positive P-wave, Negative T-wave and Negative deflection of QRS complex were predominant. Variable QRS-complexes were recorded with predominant QS deflection. The mean heart rate was 52.8 ± 1.8 and ranged between 30-142beats/minute. ECG parameters of donkeys in Sokoto differ from that of other breeds. Data generated will serve as baseline references for quick detection of deviations and early diagnosis and management of potential cardiovascular conditions in studied breed.

Key Words: Arrhythmias, Electrocardiogram, Tropics, Auraki Donkeys, Extinction, Sokoto

Description of Problem

The current trend of exportation of donkeys' hide and the increase in the rate of donkey meat consumption in some parts of Nigeria is rendering the species vulnerable to extinction and becoming endangered species with little or no information in the literature about their standard physiological variables. Donkeys are predominantly found throughout villages in northern Nigeria and were introduced from the Nile across Sudan and

Chad via an East-West route (1). Donkeys served to increase the mobility of pastoral cultures (2), in Nigeria they are used for transportation, and farming activities such as flouting of land traction (1), transport of manure and farm produce, as well as transport of sand for construction activities in some parts of the country. These activities require improved circulatory function as the animals are usually overloaded, which predisposes them to increased cardiac activity as a result of

stress, which could lead to cardiovascular diseases that could be detected using electrocardiography. Most of the information on electrocardiogram in equine is on horse with little information on donkey. A study on the normal electrocardiographic parameters of clinically healthy donkeys was reported by (3). Assessments of ECG parameters by (4) described the base-apex lead ECG variables in female donkeys, while Andreas (5) studied electrocardiographic parameters of Zamorano-leones donkeys. There is scanty literature on cardiovascular physiology of indigenous donkeys located in the arid regions of Nigeria. The objective of this study therefore is to establish the electrocardiographic tracings of the Auraki donkeys at rest to serve as baseline data for clinicians and diagnosticians for quick recognition of deviations in terms of distortions.

Materials and Methods

Ethical approval for the study was obtained from Faculty Animal Research Ethics Committee, Faculty of Veterinary Medicine, Usmanu Danfodiyo University, Sokoto. Auraki donkeys (Native of North Africa), identified by phenotypic features as described by (6) were used for the study. A total of twenty-two donkeys were sampled from two neighboring

villages; they were adjudged to be well fed and apparently healthy base on physical examination and the record of vital parameters (Temperature, pulse and respiratory rates) monitored on seventy-two hours observation. They were manually restrained without any tranquillizer or anaesthetic agent and were maintained on standing position on an insulated ground surface using a rubber mat. The methylated spirit was applied on all surfaces where the electrode cables were to be fixed. ECG recorder (EDAN VE-100 manufactured by Edan instruments® China) calibrated at a paper speed of 25mm/s and sensitivity of 10mm/mV was used to take the electrocardiograph. The red electrode was positioned and fixed cranially to the right axillary region of the forelimb next to the jugular vein; the yellow electrode was positioned and fixed on the left thorax, above the left cardiac apex, caudal to the olecranon; the black electrode was positioned on the proximal cranial region of the forelimb and the green electrode was positioned and fixed to the left inguinal region of the animal above the tibiofemoral patellar joint as described by (7). The electrocardiographic recordings were displayed on the monitor of the ECG machine, and hard copies were printed on ECG paper.

Table I: Means and SEM of Durations and Amplitudes of P, R, T and the Durations of QRS Complex, P-R interval and Q-T Interval (n = 20)

	P Duration (sec)	P Amplitude(mV)	R Duration(sec)	R Amplitude(mV)	T Duration(sec)	T Amplitude(mV)	QRS Duration(sec)	P-R Interval(sec)	QT Interval(sec)
Lead I	0.05±0.00	0.10±0.00	0.04±0.00	0.10±0.00	0.20±0.02	0.20±0.02	0.11±0.04	0.20±0.02	0.42±0.01
Lead II	0.10±0.04	0.17±0.01	0.04±0.00	0.29±0.08	0.19±0.01	0.32±0.03	0.08±0.00	0.19±0.01	0.41±0.01
Lead III	0.07±0.01	0.15±0.01	0.05±0.00	0.49±0.09	0.19±0.01	0.24±0.03	0.09±0.01	0.19±0.01	0.43±0.01
aVR	0.12±0.04	0.11±0.01	0.05±0.00	0.43±0.06	0.19±0.00	0.26±0.03	0.08±0.00	0.19±0.00	0.41±0.01
aVL	0.11±0.01	0.11±0.01	0.06±0.02	0.05±0.00	0.20±0.01	0.16±0.02	0.08±0.00	0.20±0.01	0.42±0.01
aVF	0.07±0.00	0.15±0.01	0.05±0.00	0.34±0.07	0.18±0.00	0.29±0.04	0.12±0.04	0.18±0.00	0.35±0.00

Statistical analysis

Values obtained were expressed as means and standard error of means (SEM) at 95% confidence interval CI using SPSS version 16. Inferences are depicted in figures.

Results and Discussion

The different waves recorded are as presented on the table. 1. P duration was highest in aVR and lowest in Lead II while the highest P amplitude was recorded in Lead II. Higher values of R duration and amplitude were recorded in aVL and Lead III,

respectively. T duration was also found to be higher in Lead I while the highest amplitude was found in Lead II. Higher values of QRS duration, PR and Q-T intervals were recorded in aVF, Lead I and Lead III respectively. Analysis of the standard ECG revealed both positive and negative P, T and QRS complex with the P and QRS complex more positive while the T wave was more negative as indicated in Figure 1. Various forms of complexes are recorded and are mostly biphasic, as shown in Figure 2.

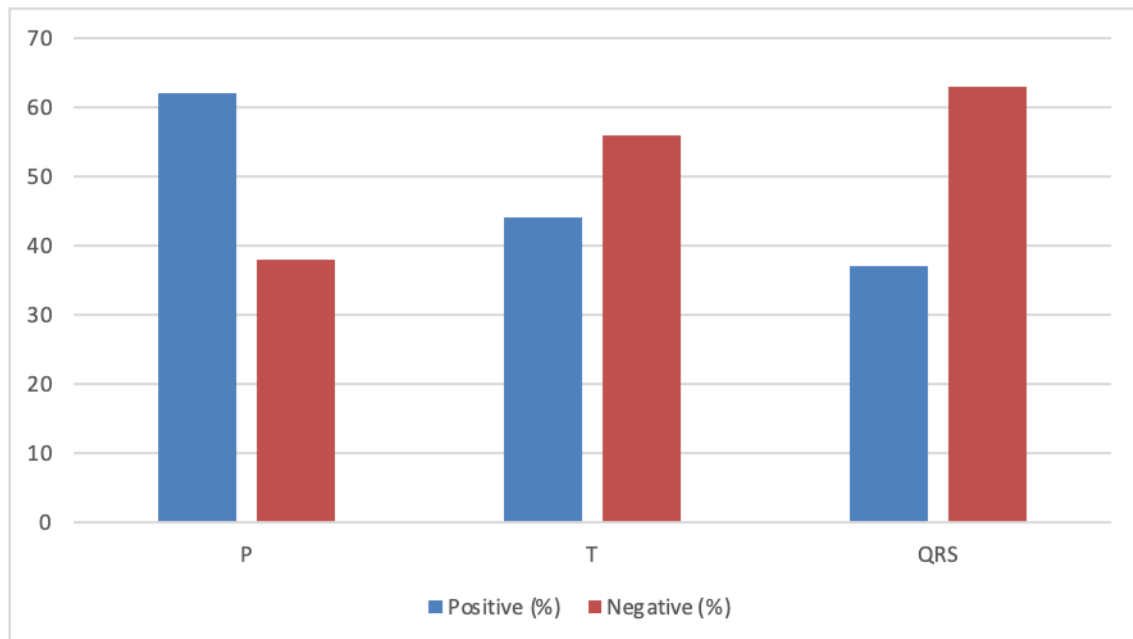


Figure 1. Percentage positive and negative P, T and QRS complex in Auraki Donkeys

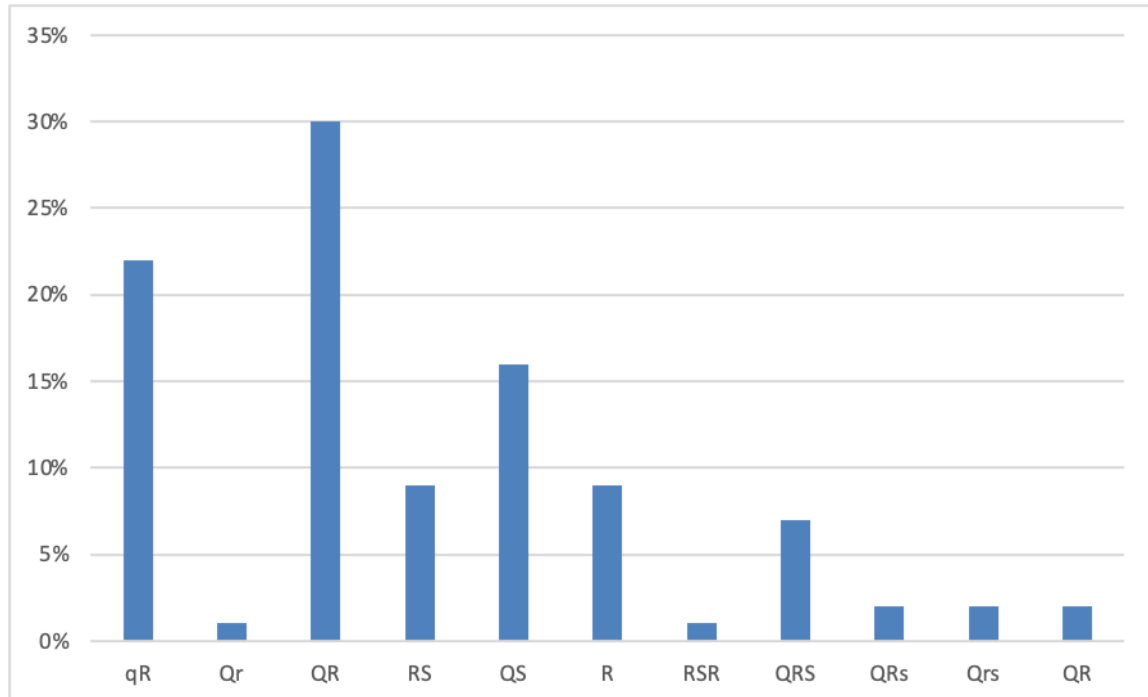


Figure 2. Percentage types of QRS complex in Auraki donkey

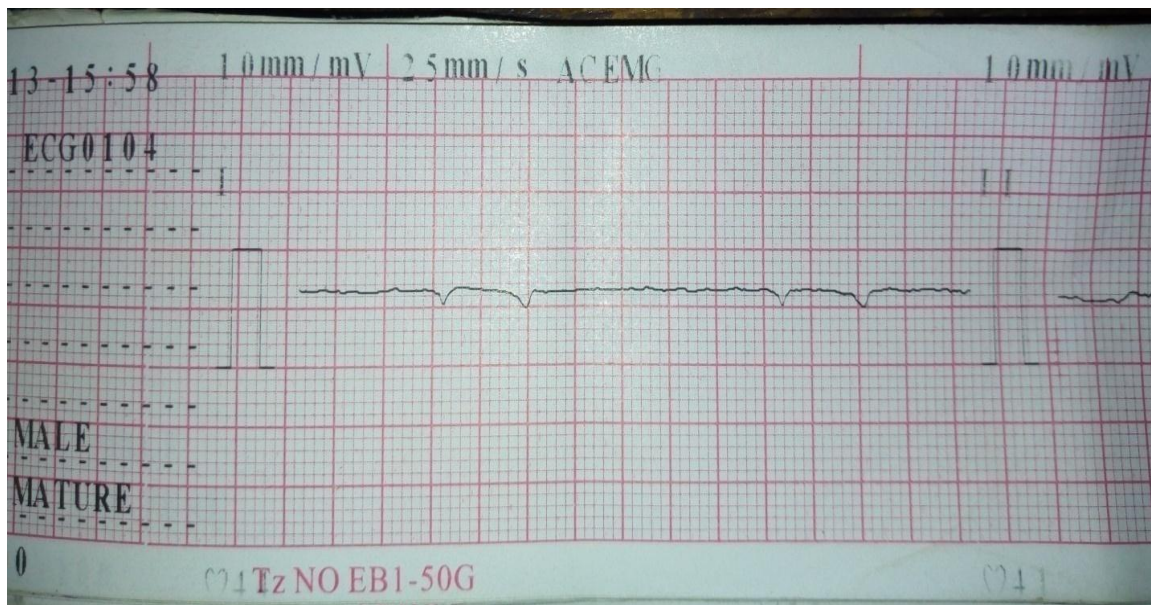


Figure 3: Electrocardiogram of Donkey showing lead I

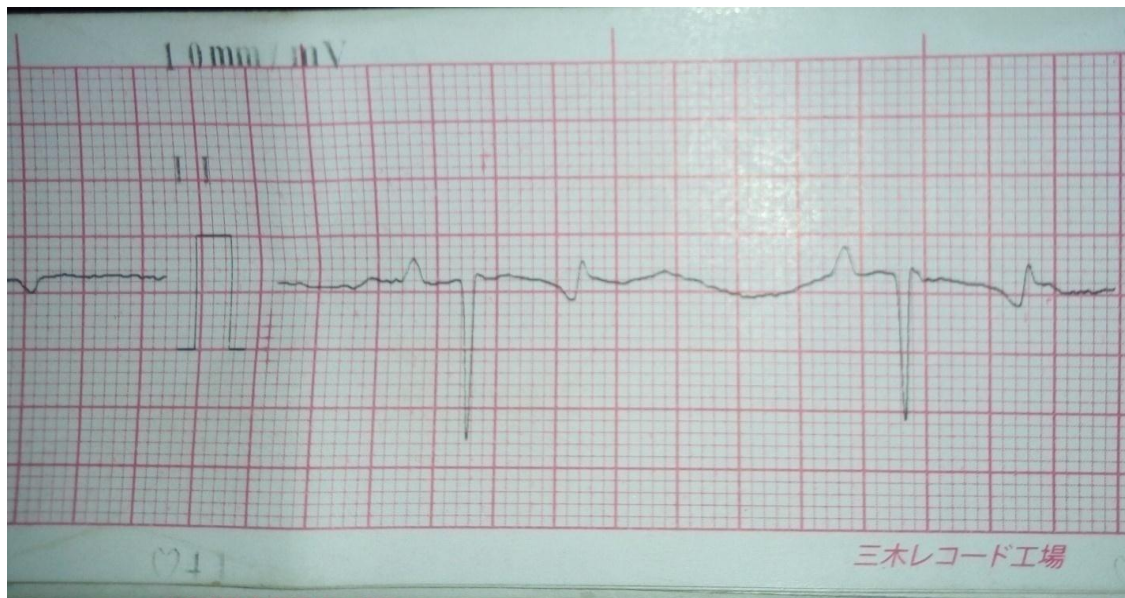


Figure 4: Electrocardiogram of Donkey showing lead II

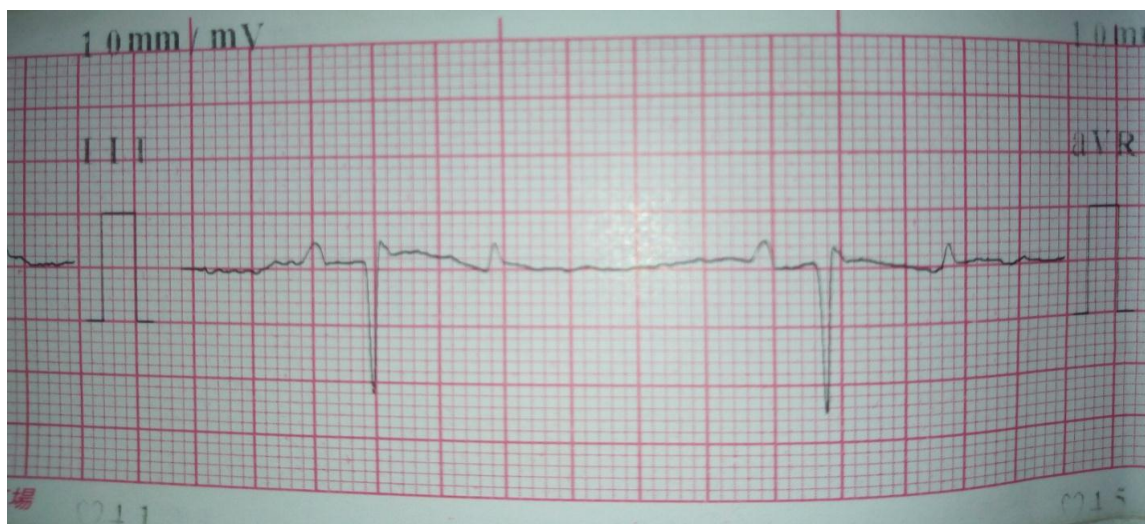


Figure 5: Electrocardiogram of Donkey showing lead III

To the best of our knowledge, this is the first description of Auraki donkey electrocardiographic parameters in Sokoto, Nigeria. This is significant, as the generated data will inform clinicians and species conservation advocates and enthusiasts about the comparative adaptation of the Auraki breeds to the Sahelian climate in northwestern

Nigeria. The highest P-wave amplitude was 0.17 ± 0.01 obtained in lead II (Figure 4), this was in agreement with those reported by (5) but differs from the findings of (4). The P-wave duration recorded was higher than the average values given by (5). At the same time, the P-R interval obtained was less than that recorded by (5) which could be suggestive of

delayed inter-atrial conduction. This could be due to higher environmental temperature that could trigger an increased venous return to enhance heat dissipation as Sokoto is a tropical region with extreme ambient temperatures.

The values of R-wave amplitude, T- wave duration and amplitude, QRS duration and Q-T interval recorded (Figure 6) were higher than those obtained by (5) and (8), this could be due to the nature of the activities the donkeys are used for. The donkeys are used for transportation of farm produce. They are often overloaded, which requires the heart to increase its activity to enhance blood supply to the musculoskeletal system to deliver more oxygen for enhanced energy generation. The difference could also be as a result of breed difference because Auraki donkey is less hairy compared to Zamorano-Leones donkeys and increased skin contact with the electrodes could enhance conduction velocity. Variable QRS-Complexes recorded agrees with the findings of (3) and (5). The heart rate recorded was within the established ranges reported by (9) and (3)

Conclusion and Application

1. The P-wave duration recorded was higher than the normal values on average when compared with previous accounts on the same species but at different locations. This may be due to temperature difference. It could also be as a result of adaptation to strenuous activity.
2. Despite fluctuations in P waves, the total heart rate (HR) recorded on average was within normal range from previous accounts. This is significant as it indicates a compensatory mechanism by the heart is efficient for the reported breed. Arrhythmias with significant deviations in heart rate at rest should raise suspicion of pathology affecting structural integrity.
3. This finding will inform the farmers using donkeys of the need for rest at intervals

and clinicians on the possible variation in ECG parameters between working donkeys and pets.

4. The findings will also inform farmers of the need to avoid over loading the animals.

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